CHAPTER II

SURVEILLANCE SYSTEMS

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A. GENERAL

Constant and close observation is required on all tropical areas and on all systems of tropical origin. The obvious need for the observation is evident in the accuracy required for warning positions. Conservation of property and life can be considered as the dividend of time and money invested in proper reconnaissance.

The accuracy of warnings is directly related to the quality and quantity of surveillance. The FWC/JTWC continually reviews methods and effectiveness of surveillance.

Continuous watch on all tropical systems is imperative so that initial warnings are issued at the earliest possible moment to insure adequate preparation in affected areas. Since there are many varied tracks and rates of intensification and the best possible method of detecting the type involved in any particular system is continuous reconnaissance, it is proposed that a minimum of four fixes a day be made on all systems for which warnings are being issued. During the 1962 season, a period of 24 hours was normally required to phase into 4 fixes daily on any system. In certain cases, this left the "rapid intensifiers" without surveillance during the most critical period of their formation to maturity. During the last quarter of the season, the squadron responsible for the required one fix on a Tropical Depression Warning was asked to have fuel aboard to remain in the area 6 hours for a second fix should intensity be 34 kts or above in order to reduce the implementing period. In 1962 the tropical cyclones that reached typhoon intensity remained tropical depressions for an average of only 3.4 warnings and tropical storms for 3.7 warnings.

B. SURVEILLANCE METHODS

Aerial reconnaissance is the primary method used in obtaining the complete data required for proper analysis of a tropical system. Aerial reconnaissance, being mobile,

provides the position, intensity, indications of past movement, changes as they occur, and significant features including eye shape, size, slope, and condition of tropical systems. In addition, it provides data, both surface and upper air, normally not available due to lack of reporting facilities in the vast oceanic areas.

During 1962, two aircraft squadrons were assigned primary responsibility of tropical reconnaissance under the requirements of the JTWC Guam. These units were the U. S. Air Force 54th Weather Reconnaissance Squadron (54WRS), Andersen Air Force Base, Guam and the U. S. Navy Airborne Early Warning Squadron One (VW-1), Naval Air Station, Agana, Guam.

The 54WRS was re-established on 18 April 1962 as a result of JTWC recommendations last year concerning the weather reconnaissance priorities system.

The 56WRS, Yokota Air Base, Japan, was primary backup for the 54WRS, and the 315th Air Division was the normal CINCPACAF theater air backup.

The various aircraft used by these squadrons are the WB-50 by the 56WRS and 54WRS, the EC121K (WV-2) Warning Star by VW-1, and the C-130 by the 315th Air Division.

In addition to requested aerial reconnaissance, reports were received from itinerant military and civilian aircraft passing through the storm areas. Although a considerable number of these reports were received, only a few were classified as bonus fixes. To be classified as a bonus fix, it must not confirm a scheduled reconnaissance fix.

Land radar, in conjunction with aerial reconnaissance, was utilized operationally when a tropical system was within radar range. Radar information was available from various CPS9 and GCI tactical radar sites.

In special cases, radar coverage is obtained from ships close enough to a center to provide a radar position. Radar reports from these ships, however, are very infrequent. It is felt that ships fail to understand the need

at JTWC for these reports. Reports are requested from ships in critical areas when they are close enough to afford assistance. Peripheral data is as important as the center data and in the case of a developing system, more important. Ships should report radar information describing echoes which are other than the normal scattered pattern. Reports of this type have not been received by JTWC in the past.

The Tiros weather surveillance satellite gives vortex positions when discernible and cloud patterns on its orbital passes over the area in the form of nephanalysis. Two cases in 1962 enabled JTWC to plan early reconnaissance into an area not previously suspect. The first was the initial stages of Typhoon VERA, which did not appear on the surface analysis even though the area was more than adequately covered by surface ship observations. The second was Tropical Cyclone #61, which was reported in an area of sparse reports. An aircraft was deployed, and an investigation was made. No circulation could be found; therefore, Tiros could have initially observed a distal system. Tiros IV, V and VI satellites were launched in 1962, 08 February, 19 June and 19 September, respectively.

C. EVALUATION OF THE 1962 SEASON

Throughout the 1962 Typhoon Season, aerial reconnaissance was divided between the 54WRS and VW-1. Under normal warning status, fixes were scheduled for 4 daily on each typhoon and 2 daily on each tropical storm. One daily investigation was scheduled on each tropical depression and as required on each cyclone. These requirements are as outlined in CINCPAC INST 3140.1D. Synoptic tracks which supplement the surface and upper air reporting stations of the U. S. Trust Territories were required at a mandatory minimum of every third day when the JTWC was not in warning status and as required or requested when in warning status.

The policy of the JTWC for laying fix requirements on the squadrons were as follows: For typhoon fixes, the 54WRS made the 2200Z and 0400Z daylight fixes, and the night aircraft radar fixes were by VW-1 at 1000Z and 1600Z. Tropical Storm fixes were generally scheduled for 2200Z and 0400Z by the 54WRS and/or VW-1. Tropical depression and cyclone investigations were scheduled for daylight hours by a single

squadron. Each squadron was assigned every other cyclone. The scheduled times for the fixes were within two hours of the bulletin time providing increased accuracy in the bulletin position. The two hours were found necessary due to communications difficulties. This procedure differed from the previous seasons when fixes were scheduled for 3 fixes in daylight by WB-50's and only 1 radar fix at night by the EC121K's. The previous procedure did not permit complete use of the information provided.

An innovation of the 54WRS was the use of two aircraft for fixing two storms by flying both storms at the same time then alternating aircraft and storms. One aircraft flew clockwise and the other, counter-clockwise. The economical savings in fuel and flight time should permit this procedure to become standard squadron policy.

There were a few exceptions to the 1962 policy of levying requirements between the squadrons. Throughout the year, higher priority missions caused the 54WRS to reduce the number of participating aircraft but did not limit their response to fixes required. During October, VW-1 encountered funding problems and were restricted to 1 fix daily per typhoon and tropical storm system and flew only one out of three cyclones for conservation purposes. Early action by that command, with FWC/JTWC support, limited this problem to less than 2 weeks.

On storms which passed into the Sea of Japan, reconnaissance was continued as normal, even after meteorological indications were that of an extratropical system, until the system passed N of Misawa AB, Japan at 42N. This procedure provided operational coverage for the Japanese Islands and U. S. military installations on those islands.

In October Typhoon GILDA was located in the Philippine Sea, and Typhoon IVY formed SE of GILDA's center. The proximity of these centers allowed the economical use of a single reconnaissance aircraft to make 2 fixes on both centers in a single sortie. This was accomplished by use of on-time fixes on GILDA and then fixes on IVY three hours later. VW-1 aircraft were able to hold both centers on radar at the same time.

D. EVALUATION OF DATA

1. Aerial Reconnaissance Data

Data received from reconnaissance can be divided into two categories, peripheral and eye.

The peripheral data is all information reported by reconnaissance aircraft enroute and around a tropical system, and eye data is the information reported from the center of a system. A synoptic track includes basically the same information as peripheral data, and a cyclone center, the same as eye data.

Peripheral data is provided by all reconnaissance aircraft; eye data is provided only by aircraft penetrating the eye or center. During 1962, daylight penetration of typhoons was scheduled for WB-50 and C-130 aircraft. Night penetration is not permitted. EC121K aircraft, due to airframe limitations, were not scheduled and were not permitted typhoon penetration. All night fixes were scheduled as aircraft radar fixes by EC121K aircraft.

Peripheral data includes weather, clouds, flight level height, wind, temperature, dew point, and estimated surface pressure and wind. Dropsondes are made in the four sectors of the system and in the wall clouds of developed storms. The information received from these is invaluable for proper analysis of pressure gradient for the Arakawa and Miller-Moore objective forecasting techniques and for determination of the intensity outside of the eye. Dropsondes are made only by WB-50 aircraft. EC121K aircraft are authorized drop chambers and will be modified prior to the next typhoon season.

The eye data obtained from a penetration includes the pressure center as found by radar altimeter and the position determined by navigation. A dropsonde is made at this point from the 700mb level. This provides the lapse rate profile to the surface, the sea level pressure, surface temperature and dew point. The surface wind is observed and the flight level wind, minimum 700mb height and maximum 700mb temperature are determined. Eye characteristics such as size, slope and shape are reported when

possible and the extent of cloudiness when it occurs. As the year 1962 progressed, a dropsonde pattern, that would be valuable operationally and for research, was established by JTWC and 54WRS. Under this system, as equipment and time permit, a drop is made when the aircraft reaches the 50 kt surface wind band, one in the eye, one just outside the wall cloud, and a fourth in the opposite quadrant from the first drop.

The eye position as determined by aircraft radar provides the center of the radar eye and a description of the radar presentation, which includes the spiral bands and the wall cloud condition. When possible, the height of the wall clouds is reported.

The surface center position, as determined by penetration, was transmitted to JTWC in degrees and tenths throughout most of the season, but during October an evaluation was made of the use of degrees and minutes. This was found to be of considerable help in determining rate of movement, especially of slowly moving systems, and has been incorporated as a standard procedure.

The data received from the 54WRS and 56WRS was generally considered equal in quality and accuracy. The equality of these two squadrons is primarily the result of previous experience in tropical reconnaissance.

The data obtained by VW-1 was equally good with few exceptions. Aircraft radar fixes were obtained from distances up to 180 MI from a center. The radar fixes made at the extreme range were not always compatible with earlier and later fixes. It was recommended and later adopted that aircraft radar fixes should be made at as close a range as possible.

Generally, information received from CINCPACAF backup aircraft, though necessary and invaluable, was inadequate and at times, inaccurate. The problem was one of air crew inexperience in tropical reconnaissance. The aircraft were not equipped for tropical reconnaissance and were unable to provide completely the information desired.

The information received from all reconnaissance aircraft was continually checked for consistency and

accuracy. Each piece of information was immediately plotted on the Wachholz Graph for continuity with previous data and for consistency with data in the same report. Discrepancies were rechecked when possible with observing aircraft.

Parameters on the Wachholz Graph are being re-evaluated and some refinements, particularly in the temperature component, will be utilized during the 1963 season.

2. Land Radar

Land Radar coverage applies only to those tropical systems which approach land areas within radar range.

The information which land radar provides includes position, usually range and bearing, and eye characteristics when they can be determined.

Generally, the position as reported by land radar is not as accurate as would be expected. The increase in distance from the radar station increases the amount of error. Land radar positions tend to place the eye closer to the observing station than it actually is. The cause can be placed on a number of variables of which attenuation, operator inexperience, state of equipment maintenance and equipment capability are factors.

During 1962, 45 fixes that would have been scheduled for VW-1 and 54WRS were not requested. Land radar stations provided the information necessary, thus saving 45 fixes which would have necessitated at least two dozen aircraft sorties.

E. COMMUNICATIONS

CW is the primary means of communications between the ground and the aircraft. AIE2, Andersen AFB, Guam is the primary air-ground contact for the aircraft; AIF8, Yokota AB, Japan is secondary; and AIC2, Clark AB, Philippine Islands and AID2, Kadena AFB, Okinawa are tertiary contacts.

AIE2, Andersen AFB, Guam is responsible for getting the reports to JTWC via the local circuit 3L28. This circuit also serves VW-1 and 54WRS. A monitor from 54WRS is on duty

at AIE2 whenever a 54WRS aircraft is in the air. This monitor checks the incoming information from 54WRS aircraft and makes any necessary queries or corrections.

VW-1 has equipped some aircraft with single side band equipment for voice communications and will have all of its aircraft so equipped in the coming year. At the present time this equipment supplements the CW facilities.

1962 AIRCRAFT RECONNAISSANCE DATA

UNIT	TROPICAL CYCLONES (56)				SYNOPTIC TRACKS	
	NO. OF SORTIES	NO. OF FIXES/ INVESTIGATIONS		FLYING HOURS	NO. OF SORTIES	FLYING HOURS
		SCHED	BONUS			
VW-1	188	243	1	1704.4	41	382.2
54WRS	151	212	1	1777.8	78	874.4
56WRS	29	36	1	337.8	7	68.8
315 AIRDIV	5	5		42.2		
OTHER USAF			4			
OTHER USN			2			
CIVILIAN			1			
TOTAL						
1962	373	496	10	3862.2	126	1325.4
1961	304	350	27	2801.0		